Available online at https://www.ijasrd.org/

International Journal of Advanced Scientific Research & Development

Vol. 05, Iss. 07, Ver. I, Jul' 2018, pp. 81 – 87

e-ISSN: 2395-6089
p-ISSN: 2394-8906

A STUDY ON ESTIMATING CARBON FOOTPRINT OF ANNAMALAI UNIVERSITY'S CAMPUS

Dr. R. Mathiyazhagan[1], Dr. T. Ramesh[1], Dr. R. Sheela[1], V. Sarath Kumar[2], Dr. R. Rajendran[3] and Dr. S. Palanivelraja[4*]

[1] Assistant Professor, Department of Civil Engineering, Annamalai University, Annamalai Nagar, Chidambaram, Tamil Nadu, India.

[2] Research Scholar, Department of Civil Engineering, Annamalai University, Annamalai Nagar, Chidambaram, Tamil Nadu, India.

[3] Assistant Professor, Department of Sociology, Annamalai University, Annamalai Nagar, Chidambaram, Tamil Nadu, India.

[4] Professor, Department of Civil Engineering, Annamalai University, Annamalai Nagar, Chidambaram, Tamil Nadu, India.

ARTICLE INFO

Article History:

Received: 26 Jul 2018;
Received in revised form: 06 Aug 2018;
Accepted: 06 Aug 2018;
Published online: 10 Aug 2018.

Key words:

Carboon Footprint (CF), Greenhouse Gas (GHG), Greenhouse Gas Emissions, Ecological Footprint (EF), Carbon Inventory, Sustainability.

ABSTRACT

Annamalai University has set goals with a firm timeline, therefore a baseline for GHG emissions must be created to develop improvement strategies and monitor progress. The primary goal of this research is to calculate a transparent carbon footprint of Annamalai University's main campus. Carbon footprints measure the amount of GHG emissions associated with human activities. Carbon foot printing of higher education institutions is currently an underdeveloped research area despite a growing movement to reduce GHGs from these systems. As a contribution to efforts on the subject, and to address Annamalai university GHG reduction efforts, this research evaluates Annamalai university operational activities that emit GHGs. The cumulative contribution of these activities creates Annamalai university carbon footprint.The main objective of this thesis is to develop an accounting tool to calculate GHG emissions, from the campus of Annamalai University and to assess their carbon inventory, footprint and their impact on climate change.

Cite this article as: Mathiyazhagan, R., Ramesh, T., Sheela, R., Kumar, S. V., Rajendran, R., & Palanivelraja, S., "A Study on Estimating Carbon Footprint of Annamalai University's Campus". *International Journal of Advanced Scientific Research & Development (IJASRD), 05* (07/I), 2018, pp. 81 – 87. https://doi.org/10.26836/ijasrd/2018/v5/i7/50713.

*** Corresponding Author:** Dr. S. Palanivelraja, pazhasee@gmail.com

INTRODUCTION

Annamalai University has set goals with a firm timeline, therefore a baseline for GHG emissions must be created to develop improvement strategies and monitor progress. The primary goal of this research is to calculate a transparent carbon footprint of Annamalai University's main campus. Carbon footprints measure the amount of GHG emissions associated with human activities. Carbon foot printing of higher education institutions is currently an underdeveloped research area despite a growing movement to reduce GHGs from these systems. As a contribution to efforts on the subject, and to address Annamalai university GHG reduction efforts, this research evaluates Annamalai university operational activities that emit GHGs. The cumulative contribution of these activities creates Annamalai university carbon footprint. From this, a secondary goal of this research is to identify which products and processes are the greatest contributors to the carbon footprint, and then provide recommendations are offered to decrease emissions. One such recommendation is the implementation of a renewable electricity source. Accordingly, a third goal of this study is creating a map to depict campus rooftops suitable for solar photovoltaic arrays.

Life Cycle Assessment (LCA) studies have arrived at three conclusions about the environmental impact.

1) The operational phase of a water utility's life cycle is the overwhelmingly leading contributor (often > 90%) to environmental impact, while the construction and commissioning phases can be neglected even in relatively extreme conditions of large infrastructure requirements (Raluy et al., 2005b).
2) Within the operational phase, energy use and more specifically, the production of electricity, is the greatest source of environmental impact (Vince et al., 2008).
3) After energy use, the chemicals used during treatment represent the second largest source of environmental impact (Vince et al., 2008).

The main objective of this thesis is to develop an accounting tool to calculate GHG emissions, from the campus of Annamalai University and to assess their carbon inventory, footprint and their impact on climate change.

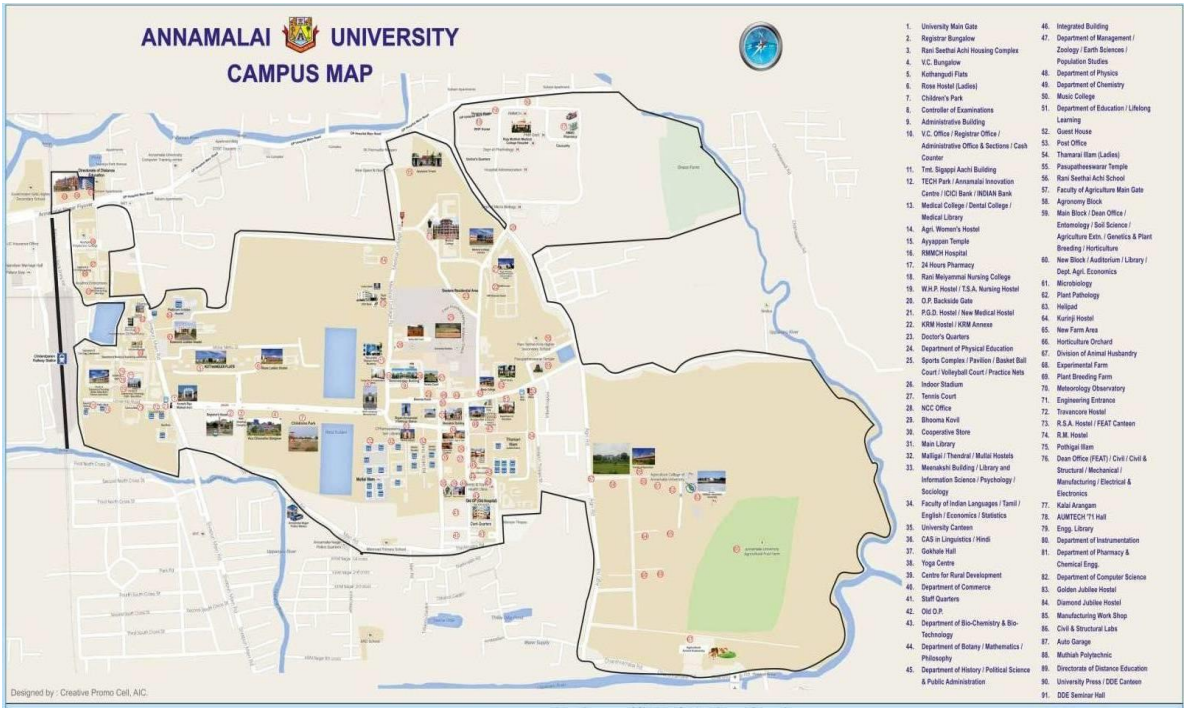
1.1 Study Area

The Study area, Annamalai University is located in Annamalai Nagar, Cuddalore District, which is in the plains of Southern Peninsula. The Annamalai Nagar region is designated by Department of Local Administration as special village panchayat and is immediately adjacent to the important temple town Chidambaram. The total geographic area of the Annamalai University is about 999 acres and the mean sea level (MSL) is + 5.74 with the Latitude and Longitude of 11°24' North and 79°44' respectively.

1.2 Annamalai University

Annamalai University is one of the prestigious world class residential University in India, very much responsible for enriching the Nation through the domains of Engineering, Agriculture, Science and Technology. The University was established in the year 1929, since then it has made spectacular progress in conquering the frontiers of intellect and education. Under able administration the university has grown rapidly and widely. Fig 1 gives the campus map of Annamalai University.

Figure – 1: *Annamalai University Campus Map*



METHODOLOGY

The California Climate Action Registry (Climate Registry) General Reporting Protocol provides basic procedures and guidelines for calculating and reporting GHG emissions from a number of general and industry-specific activities. The General Reporting Protocol is based on the "Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard" developed by the World Business Council for Sustainable Development and the World Resources Institute through "a multi-stakeholder effort to develop a standardized approach to the voluntary reporting of GHG emissions." Although no numerical thresholds of significance have been developed, and no specific protocols are available for land use projects, the General Reporting Protocol provides a basic frame work for calculating and reporting GHG emissions from the project. The information provided in this section is consistent with the General Reporting Protocol's reporting requirements.

The General Reporting Protocol recommends the separation of GHG emissions in to three categories that reflect different aspects of ownership or control over emissions. They include the following:

- **Scope 1:** Direct GHG emissions from human activity (e.g., stationary combustion of fuels, mobile combustion of fuels in transportation).
- **Scope 2:** Indirect GHG emissions associated with activities of the reporting entity but occur at sources controlled by another entity (e.g., purchased electricity or purchased steam).
- **Scope 3:** Indirect emissions associated with other emissions sources, such as third-party vehicles and embodied energy (e.g., energy used to convey, treat, and distribute water and wastewater).

In this project, an attempt has been made to develop a model called Provincial Emission Estimator (PalEE) like CalEE for calculating Greenhouse gas emitted from an

academic institution. In this study the following activities were considered for developing the PalEE Model.

The Provincial Emissions Estimator Model (PalEE-Mod) is a statewide land use emissions computer model designed to provide a uniform platform for government agencies, land use planners, and environmental professionals to quantify potential criteria pollutant and GHG emissions associated with both construction and operations from the campus of Annamalai University. PalEEMod was developed in collaboration with the can be for atmosphereic research and climate change (CARECC). Data (e.g., emission factors, trip lengths, meteorology, source inventory, etc.) will be provided to account for local requirements and conditions. The model is considered to be an accurate and comprehensive tool for quantifying air quality and GHG impacts from the campus of Annamalai University.

2.1 Computational Methodology

PalEEMod was used to calculate potential GHG emissions generated by new land uses on the campus, including area source, energy sources (electricity and natural gas), mobile source, solid waste generation and disposal, and water usage/wastewater generation.

(1) Area Source Emissions

Area source emissions were calculated using the PalEEMod emissions inventory model, which includes fireplaces and landscape maintenance equipment PalEEMod calculates GHG emissions associated with natural gas fired fire places based on emission factors from the California Climate Action Registry (CCAR) assuming an average heating rate in British Thermal Units (BTU) per hour for fireplaces in home is 60,000 BTU/hr.

The combustion of fossil fuels to operate landscape equipment such as lawn mowers and trimmers, results in GHG emissions of CO_2 and smaller amounts of CH_4 and N_2O. The emissions occur on-site and are a direct result of activity from the existing land uses; therefore, the GHG emissions are considered to be direct. The emissions for landscaping equipment are based on the size of the land uses, the GHG emission factors for fuel combustion, and the GWP values for the GHGs emitted. Annual GHG emissions from landscaping equipment in units of MTCO2e are generally calculated in PalEEModas follows:

2.2 Landscaping Equipment

Annual Emissions [MTCO2e] = (Σi(Units × EFLE × ALE × GWP)i) ÷ 106

Where: Units = Number of land use units (same land use type) [1,000 sf]
EFLE = GHG emission factor [grams (g)/1,000 sf/day]
ALE = Landscaping equipment operating days per year [day/yr]
GWP = Global warming potential [CO_2 = 1, CH_4 = 21, N_2O = 310]
106 = Conversion factor [g/MT]
i= Summation index

Note: For residential land uses, emission factors are specified in units of dwelling units (DU) instead of 1,000 sf.

2.3 Provincial Emission Estimator Model (PalEE-Mod)

In order to handle big data base, the PalEE-mod is developed in Dot Net. The PalEE-Mod is used to calculate the Carbon foot prints in the campus of Annamalai University.

Figure – 2: *PalEE Mod Main Screen*

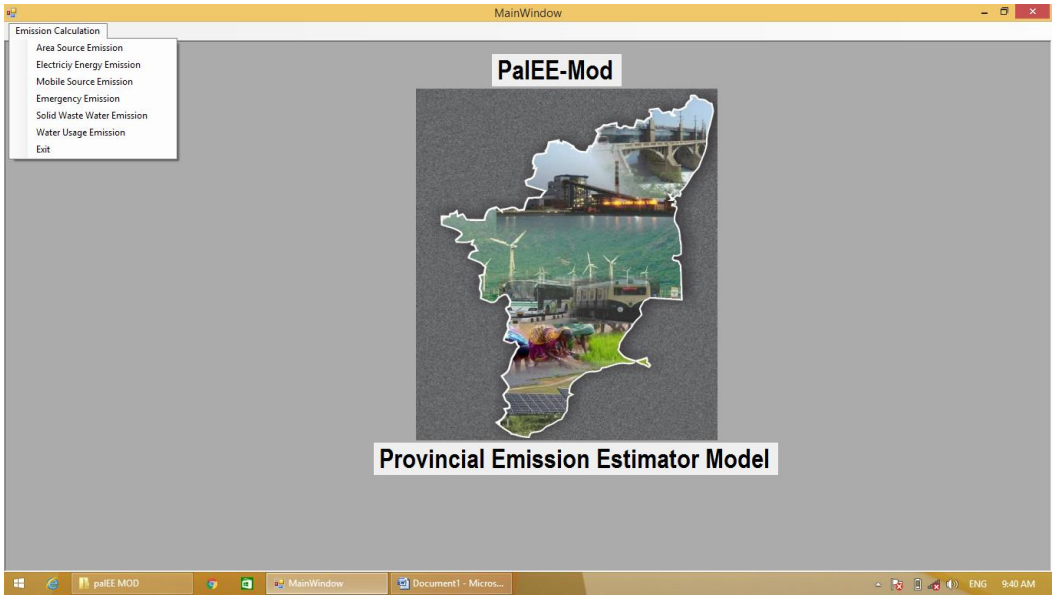
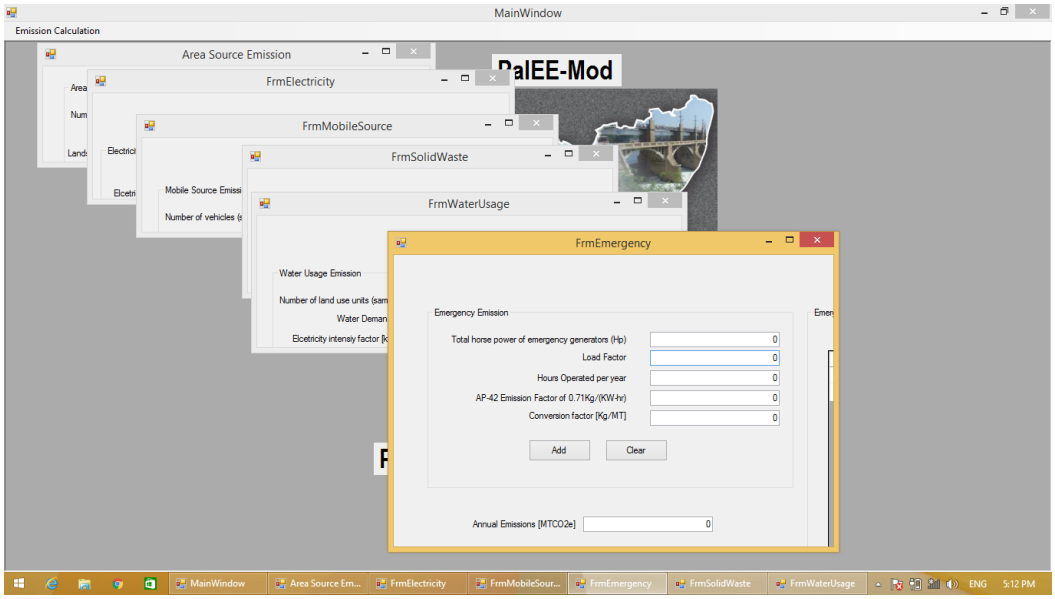


Figure – 3: *PalEE MOD Input Screen*

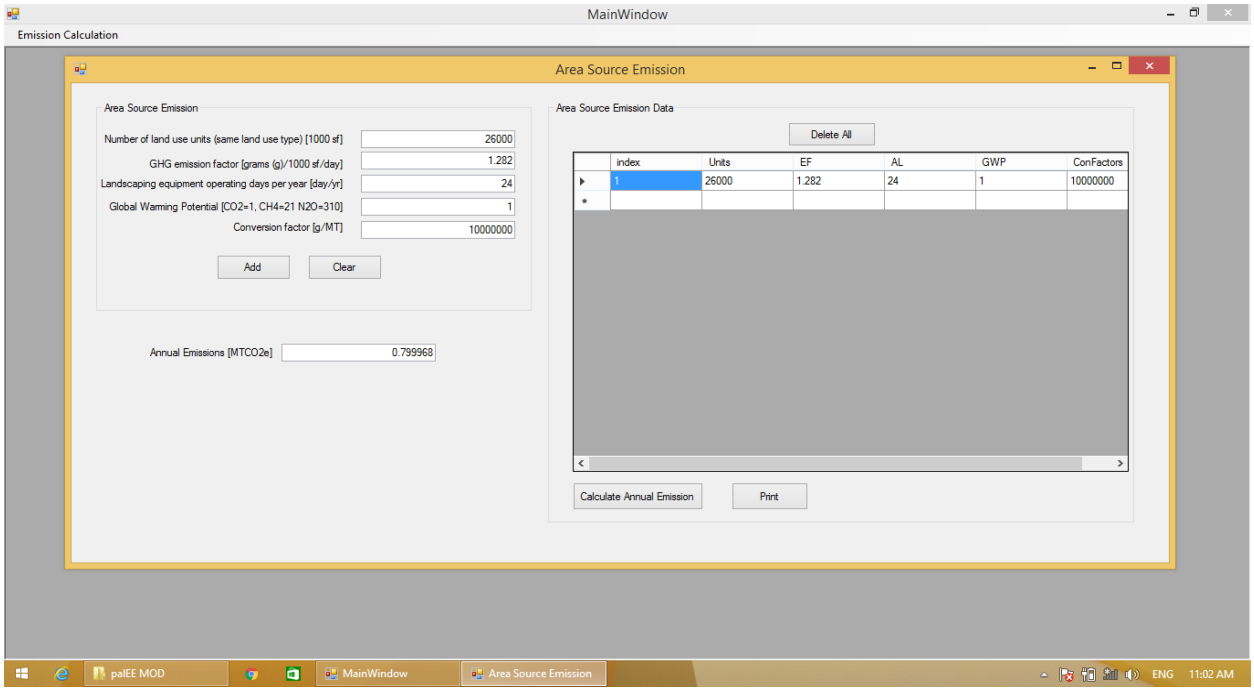


RESULTS AND DISCUSSION

3.1 Estimation of Landscape Annual CO_2 Emission

Landscape emission predicted in the gardens situated at Annamalai University, Engineering section. Gardens have totally 26000 sqft with two grass gutter fuel tank capacity of 2 liters and 1.5 hp of two pumps. The CO_2 emissions were calculated for above mentioned grass gutter and pumps. The following results were obtained by using palEE Mod emission estimator model.

Figure – 4: *Landscape Emission Estimated Screen Using palEE Mod*



CONCLUSION

Investigation of the Carbon footprint is essentially a fair evaluation of the Carbon dioxide potency in the region under study. This gave us an idea as to how our environment is contaminated. It also provided us with the details regarding the amount up to which the inventories affect emission levels, helping us to know how and up to what extend each of our actions effect changes in the environment. This study is a sure shot that would help us realize and look back at each of our activities, and how exactly it have changed the very world we inhabit. The scope of such a study is very much relevant in the current scenario of rising CO_2 levels in our very own ecosystem by using a simple handling technique PalEE model. The Carbon footprint is to be treated seriously as a quantitative yield of the quality of our very own surroundings. Necessary activity monitoring can be followed to contribute to the wellness of the planet in our own little ways. Awareness and Commitment can go a long way in keeping our environment clean. This study was undertaken with the sole motive to identify the activities and related factors that contribute to the excessive CO_2 emission, and to suggest measures and follow the suggestions that are to be put into practice for a cleaner, greener tomorrow.

REFERENCES

[1] Abas, N., & Khan, N., (2014) Carbon conundrum, climate change, CO2 capture and consumptions. *J CO2 Util, 8*, 39 – 48. 10.1016/j.jcou.2014.06.005.

[2] IPCC. Summary for Policymakers. 2014. DOI: 10.1017/CBO9781107415324.

[3] Marland G, Boden TA, Andres RJ. Global, Regional, and National Fossil-Fuel CO2 Emissions. 2008.

[4] IPCC. Climate Change (2014) Mitigation of Climate Change. DOI: 10.1017/CBO9781107415324.10.1017/CBO9781107415416.

[5] Abas, N., Kalair, A., & Khan, N., (2015) Review of fossil fuels and future energy technologies. *Futures, 69*, pp. 31 – 49. 10.1016/j.futures.2015.03.003.

[6] Lissy, M. P. N., (2012) "Carbon Footprint of an Educational Institution as a Technique for Sustainable Development". *The Internatinal Journal of Engineering and Science (IJES), 1* (2), pp. 196 – 200.

[7] Johnston, A. H., & Karanfil, T., (2013) "Calculating the Greenhouse Gas Emissions of Water Utilities". *Journal – American Water Works Association, 105* (7), pp. E363 – E371. DOI: 10.5942/jawwa.2013.105.0073.

[8] Sowmiya, C., & Mangaiyarthilagam, P., (2016) "Carbon Footprint Analysis in Kavery Engineering College", *International Journal of Modern Trends in Engineering and Science, 3* (7), pp. 139 – 142.